

WHAT IS CLAIMED IS:

1. A human-powered vehicle (100, 560, 630) comprising:

a structural frame (105, 544, 580, 638);

two front wheels (110) mounted to fixed axles at a forward portion of the frame (105) for
5 rotation;

a seat (115, 572, 632, 682) secured to the frame, the seat positioned between the front
wheels (110) and adapted to pivot about a seat pivot axis; and

a steerable rear wheel (120) mounted to the frame (105, 544, 580, 638) behind the seat
(115) and defining a rear wheel kingpin axis, the rear wheel (120) operably linked to the seat
10 (115) such that pivoting of the seat (115) about the seat pivot axis causes pivoting the rear wheel
(120) about the kingpin axis to steer the vehicle (100).

2. The vehicle of claim 1 wherein the seat pivot axis is substantially vertical.

3. The vehicle of claim 1 wherein the seat (115, 572, 632, 682) is operably linked to the
steerable rear wheel (120) by a substantially horizontal steering shaft (592).

15 4. The vehicle of claim 1 further comprising at least one neutral bias actuator (581, 639)
disposed between the seat (115, 572, 632, 682) and the vehicle frame (105, 544, 580, 638) for
biasing the rear wheel (120) toward a centered, straight-ahead position.

5. The vehicle of claim 1 wherein the seat (632) is operably linked to the steerable rear
wheel (120) by a hydraulic steering assembly (642).

20 6. The vehicle of claim 5 wherein the hydraulic steering assembly (642) comprises left and
right master cylinders (648, 650) connected to right and left slave cylinders (654, 652),
respectively, by hydraulic lines (658).

7. The vehicle of claim 1 wherein the seat (682) is operably linked to the steerable rear
wheel (120) by a rack and pinion steering assembly (692).

8. The vehicle of claim 7 wherein the rack and pinion steering assembly (692) further comprises:

a vertical steering shaft (694) affixed to the seat (682) at an upper end thereof;

a forward pinion gear (696) affixed to the lower end of the vertical steering shaft (694);

5 a gear rack (698) configured to engage the forward pinion gear (696) along a forward portion; and

a rear pinion gear (700) affixed to the rear wheel assembly (706) and engaging a rear portion of the gear rack (698).

9. The vehicle of claim 1 wherein the seat pivot axis is declined toward the front wheels
10 (110) to define a declination angle, wherein the declination angle is between about 25 and 75 degrees.

10. The vehicle of claim 9 wherein the declination angle is about 45 degrees.

11. The vehicle of any of the above claims wherein at least one of the two front wheels (110) is operably connected to a hand-operable crank (250) for propulsion of the vehicle (100).

15 12. The vehicle of any of the above claims further comprising two independent hand-operable cranks (250), each crank operably connected to a corresponding front wheel (110).

13. The vehicle of any of the above claims further comprising at least one reverse drive (300) for rearward propulsion of the vehicle (100).

14. The vehicle of claim 1 wherein the seat pivot axis is substantially horizontal.

20 15. The vehicle of claim 14 further comprising a seat steering assembly (500) configured for rotatable attachment about the seat pivot axis, the seat steering assembly further comprising a seat frame (512) attached thereto, for supporting the seat (115).

16. The vehicle of claim 15 further comprising neutral bias actuators (540) extending between the seat frame (512) at a first end and the structural frame (544) at a second end.

17. The vehicle of claim 15 wherein a steering shaft assembly (518) operably connects the seat steering assembly to the rear wheel assembly (552).

18. The vehicle of claim 15 wherein the steering shaft assembly (518) further comprises an upper steering shaft (516) and a lower steering shaft (530), the upper steering shaft (516) being coupled to the seat steering assembly (500) at a first end and coupled to the lower steering shaft (530) at a second end, the lower steering shaft (530) being coupled to the upper steering shaft (516) at a first end and coupled to the rear wheel assembly (552) at a second end.

19. The vehicle of claim 18 wherein the upper and lower shafts (516, 530) are substantially non-collinear.

20. The vehicle of claim 18 wherein the upper and lower shafts (516, 530) are coupled together by a roller chain (528).

21. The vehicle of claim 18 wherein the lower steering shaft (530) is coupled to the rear wheel assembly (552) with a bevel gear assembly (534, 536).

22. The vehicle of claim 12 wherein the hand-operable cranks (250) comprise crank sprockets (255) and the front wheels (110) include wheel sprockets (270), the crank sprockets (255) being coupled to the wheel sprockets (270) by means for positive engagement.

23. The vehicle of claims 2, 9 and 14 wherein the seat (115) is operably connected to the rear wheel (120) by a flexible chain, roller chain, cable or nylon belt (185, 215).

24. The vehicle of any of claims 9 to 10 wherein a chain (215) is trained around a driven sprocket (180) secured to the rear wheel steering assembly (120), the chain (215) attached directly to first and second portions of the seat (115) by first and second cables (220), the chain (215) being crossed between the driven sprocket (180) and the first and second portions of the seat (115).

25. The vehicle of claim 24 wherein the chain (215) is adjustably attached to at least one of the first and second cables (220).

26. The vehicle of claim 24 further comprising first and second guides (230) to redirect the cables (220) from a substantially horizontal orientation to a substantially vertical orientation.

27. The vehicle of claim 23 wherein a chain (185) is trained about a drive sprocket (175) secured to the seat (115) and a driven sprocket (180) secured to the rear wheel steering assembly (120), the chain being crossed between the drive and the driven sprockets.

28. The vehicle of claim 27 wherein the drive sprocket (175) is disposed on a seat support shaft allowing alignment of the rear wheel relative to the seat position.

29. The vehicle of any of the above claims wherein a steering damper (197) is connected to the rear wheel steering assembly (120) and the structural frame (105).

30. The vehicle of any of the above claims further comprising independent and hand-operable front brakes (355) and rear brakes (365).

31. The vehicle of any of the above claims wherein the structural frame (105) further comprises an adjustable footrest (128) positioned between the front wheels (110).

32. The vehicle of any of the above claims wherein the front wheels (110) are each mounted for rotation about a respective axle secured to the frame (105) by a fork spanning the wheel.

33. The vehicle of any of the above claims wherein the front wheels (110) are each mounted for rotation about a cantilevered axle secured to the frame (105).

34. The vehicle of any of the above claims wherein the front wheels (110) are slanted toward each other to define a positive camber angle with respect to vertical.

35. The vehicle of any of the above claims wherein the camber angle is between about 1 and 10 degrees.

36. The vehicle of any of the above claims wherein the seat (115) is positioned such that the rear wheel (120) carries between about 20 and 40 percent of a total combined weight of the operator and the vehicle (100) when in a static condition.

37. The vehicle of claim 1 wherein the structural frame (105) is supported on multiple road wheels including a driven wheel rotatable (110) about an axle for propulsion; said vehicle further comprising:

5 a hand-operable crank (250) having a crank drive shaft (387) extending therefrom enclosed within a crank drive shaft housing (388), the hand-operable crank (250) being disposed above the driven wheel (110) and rotatable by hand by an operator seated in the seat (115); and

a main drive shaft (393) enclosed within a main drive shaft housing (390) extending between the crank drive shaft housing (388) and the axle, the main drive shaft (393) operably connecting the crank drive shaft (387) and the driven wheel (110).

10 38. The vehicle of claim 37 further comprising a hand-retractable spring plunger (401) and a roller clutch (386) disposed within the crank arm housing (385) for engaging and disengaging the hand crank from the drive shaft (393).

39. The vehicle of claim 37 wherein the driven wheel (110) includes a modified internal gear coaster brake hub.

15 40. The vehicle of claim 37 wherein the vehicle is propelled by rotational motion of the hand-operable crank (250).

41. The vehicle of claim 37 wherein the vehicle is propelled by a ratcheting motion of the hand-operable crank (250).

20 42. The vehicle of claim 37 wherein the driven wheel axle is mounted in a fixed orientation to a forward portion of the frame (105).

43. The vehicle of claim 37 wherein the road wheels include two driven wheels (110), one on either side of the seat (115), and two independently operable hand cranks (250), each hand crank operably connected to a respective one of the driven wheels (110) through a respective crank drive shaft (387) and a respective main drive shaft (393).

25 44. The vehicle of claim 37 wherein the seat pivot axis is substantially vertical.

45. The vehicle of claim 37 wherein the seat pivot axis is substantially horizontal.
46. The vehicle of claim 37 wherein the seat pivot axis is declined toward the driven wheels (110) to define a declination angle of between about 25 and 75 degrees.
47. The vehicle of claim 37 wherein the main drive shaft (393) is coupled to the crank drive shaft (387) by bevel gearing (391, 392).
48. The vehicle of claim 37 wherein the main drive shaft (393) is fully enclosed within the main drive shaft housing (390).
49. The vehicle of claim 38 wherein the hand-retractable spring plunger (401) is configured to propel the vehicle in a fixed forward drive mode.
- 10 50. The vehicle of claim 38 wherein the hand-retractable spring plunger (401) is configured to propel the vehicle in a fixed reverse drive mode.
51. The vehicle of claim 38 wherein the roller clutch (386) and the hand-retractable spring plunger (401) are configured to propel the vehicle in a free wheel forward drive mode.
- 15 52. The vehicle of any of the above claims wherein the vehicle is configured to permit an operator having the use of only one hand to both steer and propel the vehicle.